01-0864

GE
159 Plastics Avenue
Pittsfield, MA 01201
USA

Transmitted Via FedEx

July 13, 2005

Mr. William Lovely
United States Environmental Protection Agency
One Congress Street, Suite 1100
Boston, MA 02114-2023

Re: GE-Pittsfield/Housatonic River Site
Building 71 and Hill 78 On-Plant Consolidation Areas (GECD200)
2005 Construction/Consolidation Activities

Dear Mr. Lovely:

On June 15, 2005, the General Electric Company (GE) distributed a letter summarizing the 2005 construction and consolidation activities anticipated to be conducted at the Building 71 and Hill 78 On-Plant Consolidation Areas (OPCAs). Following the U.S. Environmental Protection Agency's (EPA's) review, the EPA provided draft comments to GE in a facsimile dated July 6, 2005.

Following receipt of EPA's comments a teleconference among representatives of EPA and GE was conducted on July 11, 2005 to discuss the EPA's comments. Based on those discussions, GE has revised certain technical drawings and specifications included with the letter. Specifically, the following revisions were made:

- Technical Drawing 6: a key is added at the termination of the riprap drainage inlet;
- Specification 02200, Part 3.02 B: the use of on site material as backfill has been clarified;
- Specification 02200, Part 3.03 A: additional requirements to place fill in an upslope direction is included;
- Specification 02200, Part 3.04 C.9: a minimum number of Modified Proctor Compaction Tests is provided;
- Specification 02222, Part 1.03 B: a requirement for grain size analyses is added;
- Specification 02232, Part 2.02 D: the permittivity of the Type I geotextile is added; and
- Specification 02234, Part 3.01 D.2.e: the table title for seam properties was modified to include all seams (i.e., trial seams and field seams).

The above-listed drawings and specifications are attached to this letter for your review and final approval.

We trust that these revisions are sufficient to address EPA's comments and the letter can be conditionally approved. If you have any further questions, please feel free to contact me.

Sincerely,

John F. Novotny /WAR

John F. Novotny, P.E.
Manager, Facilities and Brownfields Programs

CAA/mbg
Attachments

cc: Dean Tagliaferro, EPA
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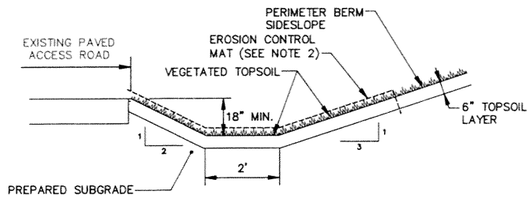
Nancy E. Harper, MA AG*
Dale Young, MA EOEA
Tom Hickey, Director, PEDA
Mayor James Ruberto, City of Pittsfield
Pittsfield Department of Health
Jeffrey Bernstein, Bernstein, Cushner & Kimmell
Teresa Bowers, Gradient
Michael Carroll, GE*
Andrew Silfer, GE
Roderic McLaren, GE*
James Nuss, BBL
James Bieke, Goodwin Procter
Public Information Repositories
GE Internal Repository

**cover letter only*

Attachments

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

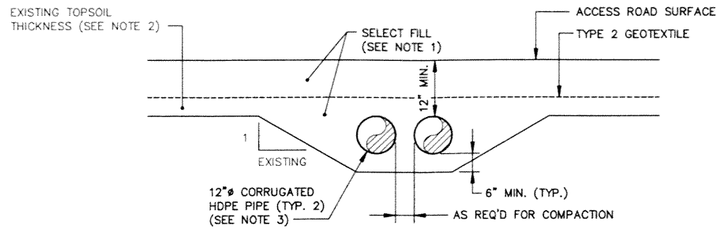


NOTES:

1. EROSION CONTROL MAT SHALL BE NORTH AMERICAN GREEN SC150 OR EQUAL INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS.

PERIMETER DRAINAGE DITCH (1)

NOT TO SCALE

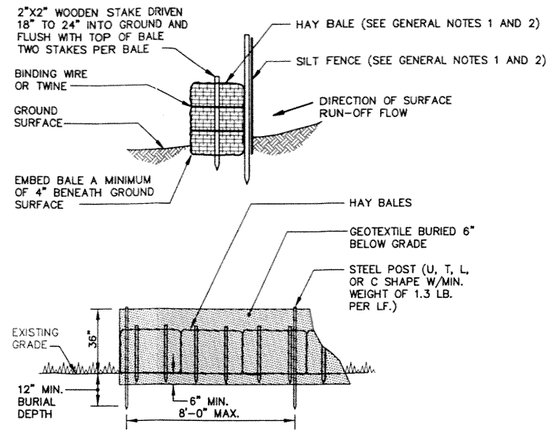


NOTES:

1. SELECT FILL SHALL BE COMPACTED DENSE GRADE CRUSHED STONE M2.01.7 OR EQUAL.
2. EXISTING TOPSOIL AND VEGETATION TO BE REMOVED BENEATH ACCESS ROAD AND CULVERT PRIOR TO PLACEMENT OF SELECT FILL MATERIAL.
3. CORRUGATED HDPE PIPE SHALL BE ADS N-12 OR EQUIVALENT. CONTRACTOR SHALL INSTALL PIPE IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.

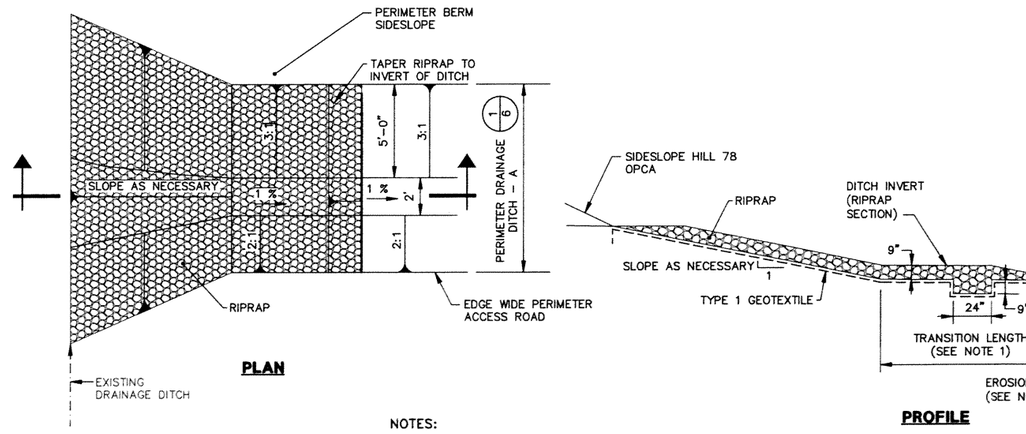
CULVERT (2)

NOT TO SCALE



HAY BALE/SILT FENCE (4)

NOT TO SCALE

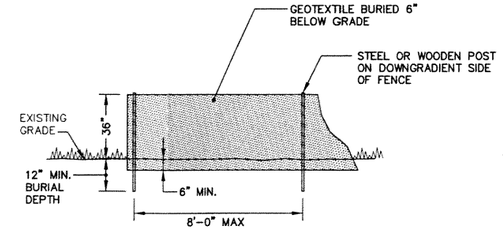


NOTES:

1. RIPRAP WITHIN DITCH TRANSITION LENGTH SHALL BE SORTED AND GRADED TO PROVIDE FOR MAXIMUM FLOW DISTRIBUTION AND VELOCITY DISSIPATION.

PERIMETER DRAINAGE DITCH INLET (3)

NOT TO SCALE



SILT FENCE (5)

NOT TO SCALE

GENERAL NOTES:

1. HAY BALES AND SILT FENCING WILL BE REMOVED BY THE CONTRACTOR WHEN REQUESTED BY GE.
2. THE CONTRACTOR SHALL MAINTAIN THE INTEGRITY OF THE HAY BALES AND SILT FENCING AS LONG AS THEY ARE NECESSARY.

X: 20405X00.DWG
L: ON=*, OFF=REF*
P: PAGESET/PLT-CDL
7/12/05 SYR-85-GMS LAF BGP
C/20405001/CONSOL/20405G06.DWG

Graphic Scale: AS SHOWN

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED IN THE TITLE BLOCK. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED. **USE THE GRAPHIC SCALE BAR IN THE TITLE BLOCK TO DETERMINE THE ACTUAL SCALE OF THIS DRAWING.**

No.	Date	Revisions	Init

Professional Engineer's Name: James M. Nuss
Professional Engineer's No.: 38000
State: MASS. Date Signed:
Project Mgr.: WAR Designed by: PHB Drawn by: GMS

BLASLAND, BOUCK & LEE, INC. engineers, scientists, economists

GENERAL ELECTRIC COMPANY, • PITTSFIELD, MASSACHUSETTS
BUILDING 71 OPCA CELL 3 BASELINER CONSTRUCTION

EROSION CONTROL AND DRAINAGE DETAILS

GENERAL

BBL Project No. 204.05
Date JULY 2005

Blasland, Bouck & Lee, Inc.
Corporate Headquarters
6723 Towpath Road
Syracuse, NY 13214
315-446-9120

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MATERIALS AND PERFORMANCE - SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. All labor, materials, services, and equipment necessary to complete the earthwork activities as depicted on the Technical Drawings and/or as directed by GE or GE's Representative.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section MP-02110 - Clearing and Grubbing
B. Section MP-02207 - Restoration of Surfaces
C. Section MP-02222 - Soil Fill Materials

1.03 SUBMITTALS

A. Contractor's proposed method(s) of compaction and equipment.

1.04 APPLICABLE CODES, STANDARDS AND SPECIFICATIONS

A. American Society for Testing and Materials (ASTM)

1.05 DEFINITION

A. Earthwork is defined to include, but is not limited to, clearing, pavement removal, rough grading, excavation for subgrades, trenching, handling and disposal of surplus materials, maintenance of excavations, removal of water, backfilling operations, embankments and fills, and compaction.

PART 2 - PRODUCTS

Specified elsewhere.

PART 3 - EXECUTION

3.01 UNAUTHORIZED EXCAVATION

A. The Contractor shall not be entitled to any compensation for excavations carried beyond or below the lines and subgrades prescribed in the Technical Drawings. The Contractor shall refill such unauthorized excavations at its own expense and in conformance with the provisions of this Section.

B. Should the Contractor, through negligence or for reasons of its own, carry its excavation below the designated subgrade, appropriate materials specified in MP Section 02222 - Soil Fill Materials shall be furnished and placed as backfill in sufficient quantities to reestablish the required subgrade surface. Soil fill materials used for backfilling shall be spread and compacted in conformance with the requirements of later subsections of this section, and to

the percentage compaction outlined therein. The cost of any tests required as a result of this refilling operation shall be borne by the Contractor.

C. All material which slides, falls, or caves into the established limits of excavations due to any cause whatsoever, shall be removed and disposed of at the Contractor's expense, and no extra compensation will be paid to the Contractor for any materials ordered for refilling the void areas left by the slide, fall, or cave-in.

3.02 BACKFILL MATERIALS

A. Soil fill material shall be used as specified for backfill, and when excavated material cannot be used as backfill. Requirements for off-site soil fill materials are specified in MP Section 02222 - Soil Fill Materials.

B. If the excavated material on site is approved in advance by GE or GE's Representative for reuse and as being suitable for filling or backfilling purposes, it shall be used as general fill material. If the excavated material on site has a maximum particle size of 2 inches, it may be approved for use as Type I General Fill.

C. On-site material is designated as "native fill" or "existing soil" material.

D. When on-site material is used, the Contractor shall remove all frozen material, boulders (over 6-inch diameter), trash, and debris, from such material prior to placement.

E. If it so elects, the Contractor may, at its own expense, substitute other types of material specified elsewhere in place of native fill material, provided such substitution is approved in advance by GE or GE's Representative and provided that all replaced material is disposed of as specified in the Contractor's Operations Plan.

3.03 GENERAL BACKFILLING REQUIREMENTS

A. Backfill shall be started at the lowest section of the area to be backfilled so that fill is placed in an upslope direction only.

B. Drainage of the areas being backfilled shall be maintained at all times.

C. Areas to be backfilled shall be inspected prior to backfilling operations. All unsuitable materials and debris shall be removed.

D. Backfill material shall be inspected prior to placement and all roots, vegetation, organic matter, or other foreign debris shall be removed.

E. Stones larger than 6 inches in any dimension shall be removed or broken.

F. Stones shall not be allowed to form clusters with voids.

MATERIALS AND PERFORMANCE - SECTION 02200

EARTHWORK

G. Backfill material shall not be placed when moisture content is too high to allow proper compaction.

H. When material is too dry for adequate compaction, water shall be added to the extent necessary.

I. No backfill material shall be placed on frozen ground nor shall the material itself be frozen or contain frozen soil fragments when placed.

J. No calcium chloride or other chemicals shall be added to prevent freezing.

K. Material incorporated in the backfilling operation that is not in satisfactory condition shall be subject to rejection and removal at the Contractor's expense.

L. If the Contractor fails to stockpile and protect on-site excavated material acceptable for backfill, then the Contractor shall provide an equal quantity of acceptable off-site material at no expense to GE.

M. A minimum soil cushion of 24 inches (measured prior to compaction) shall be maintained between construction equipment and geosynthetics with the exception of backfill material placed over the geosynthetics anchor trench. For the anchor trench, a minimum soil cushion of 12 inches (measured after compaction) shall be maintained between construction equipment and geosynthetics.

N. With the exception of backfill placed directly over geosynthetics, the maximum lift thickness is 12 inches (measured prior to compaction).

O. Extreme care share shall be taken to avoid damaging geosynthetic materials during placement of soil material above the geosynthetics.

3.04 METHOD OF COMPACTION

A. General

1. The Contractor shall adopt compaction methods that shall produce the degree of compaction specified herein, prevent subsequent settlement, and provide adequate support.

2. Methods used shall avoid disturbance to underlying soils and to subsurface utilities.

3. Before filling or backfilling is begun, the Contractor shall submit in its Operations Plan the equipment and method for compaction that it proposes to use.

4. Hydraulic compaction by ponding or jetting shall not be permitted.

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EARTHWORK

5. Backfill material shall not be left in an uncompacted state at the close of a day's construction.

6. Prior to terminating work, the final layer of compacted fill, after compaction, shall be rolled with a smooth-drum roller if necessary to eliminate ridges of soil left by tractors, trucks, or other equipment used for compaction.

7. As backfill progresses, the surface shall be graded such that no ponding of water shall occur on the surface of the fill.

8. Fill shall not be placed on snow, ice, or soil that was permitted to freeze prior to compaction.

9. Unsatisfactory materials shall be removed prior to fill placement.

B. Equipment

1. Generally, equipment for compaction shall be the largest equipment consistent with space limitations of the work areas and the need to protect adjacent facilities and underlying materials.

2. Compaction of fill material in confined areas, such as the base liner anchor trench, shall be accomplished by means of a drum-type, power driven, hand-guided vibratory compactor, or by hand-guided vibratory plate tampers.

3. If the proposed method does not give the degree of compaction required, an alternate method shall be adopted until the required compaction is achieved.

4. The moisture content of backfill or fill material shall be adjusted, if necessary, to achieve the required degree of compaction.

C. Minimum Compaction Requirements

1. Unless specified otherwise on the Technical Drawings or in these specifications, the degree of compaction specified for the various items listed in Table 1 shall be the minimum allowable.

2. Unless the Contractor can successfully demonstrate that its methods shall produce the required degree of compaction, materials to be compacted shall be placed in layers not exceeding the uncompacted thicknesses listed in Table 1.

3. In-place density tests shall be required at a minimum of one test per each lift of backfill placed, at a frequency of 1 passing test per 2,500 square feet of subgrade, 100 cy of soil fill, or 100 linear feet of trench.

MATERIALS AND PERFORMANCE - SECTION 02200

EARTHWORK

4. GE or GE's Representative may require additional in-place density tests to ascertain conformance with the compaction requirements shown on Table 1.

5. The Contractor shall dig test holes at no additional cost to GE when requested for the purpose of taking an in-place density test below the current fill level.

6. The Contractor shall provide free access to trenches and fill areas to make such tests. Payment for these tests shall be made by the Contractor.

7. The Contractor shall anticipate time needed due to testing procedures and shall not have claims for extra compensation occasioned by such time.

8. Minimum field compaction requirements in Table 1 are expressed as a percentage of the maximum dry density of the material compacted using the Modified Proctor Compaction Test (ASTM D1557).

TABLE 1
MINIMUM COMPACTION REQUIREMENTS

Type of Backfill	Maximum Uncompacted Layer Thickness (Inches)	Minimum Compaction (Percent)
1. Subgrade – Native Soil	Not applicable	Proof-rolling
2. Liner Subbase (existing or native soil)	8	90
3. Embankments and Fills	12	90
4. Anchor Trench	12	90

9. Compaction curves will be established using the Modified Proctor Compaction Test ASTM D1557 for the full range of soil materials, including soil fill and existing soil, and shall be developed by the Contractor. There will be a minimum of two compaction tests for each soil material; one curve will be established at the beginning of backfill placement and one curve will be established at approximately half way through backfill placement. Additional compaction tests may be required if material property changes are identified by GE or GE's Representatives. Payment for these tests shall be made by the contractor.

10. Proof-rolling shall be performed prior to placing material over any existing (or native) soils.

11. When proof-rolling existing (or native) soils, the layer shall be acceptable when deformations caused by site equipment (e.g., roller, dump truck) are no deeper than

one-inch. All soft or wet materials that continue to deform more than one-inch shall be removed and replaced with suitable material.

3.05 BACKFILL FOR ANCHOR TRENCHES

A. General

1. Anchor trench backfill shall be placed in 12-inch-thick loose lifts and thoroughly compacted by approved mechanical methods to ensure firm bedding. Refer to Table 1 for density requirements.

3.06 BACKFILLING EMBANKMENTS AND EXCAVATIONS

A. General

1. Embankment areas shall be cleared and grubbed prior to initiating fill operations.

2. Embankments and excavations shall be formed or backfilled with satisfactory materials placed in successive layers, approximately horizontal, of not more than 12-inches in loose depth for the full width of the embankment or excavation.

3. All materials placed in constructing the embankment shall be free of organic matter, leaves, grass, roots, and other objectionable material.

4. At all times the Contractor shall slope the embankment to provide surface drainage.

5. The materials placed in the layers shall be of the proper moisture content to obtain the prescribed compaction.

6. Wetting or drying the material to secure a uniform moisture content throughout the layer may be required.

B. Compaction

1. Rolling operations shall be continued until the backfill is compacted to the density as specified in Subsection 3.04 (above) entitled Method of Compaction.

2. Any areas inaccessible to rollers shall be compacted by mechanical tampers.

3. In the construction of embankments, starting layers shall be placed in the deepest portion of the fill, and as placement progresses, layers shall be constructed approximately horizontal, maintaining drainage and keying layers into adjoining slopes.

4. The compaction equipment shall be of such design, weight, and quantity as to obtain the required density.

MATERIALS AND PERFORMANCE - SECTION 02200

EARTHWORK

3.07 GRADING

A. After completing all fill and backfill operations, the Contractor shall grade the site to the lines, grades, and elevations shown on the Technical Drawings, taking into account any subsequent site restoration requirements.

3.08 EXISTING FACILITIES

A. General

1. Existing subsurface facilities may be encountered during construction of the work, or located in close proximity to the work.

2. These facilities may include, but are not necessarily limited to, sewers, drains, water mains, conduits and their appurtenances. These facilities may not be shown on the Technical Drawings. However, the sizes, locations, and heights or depths (if indicated) are only approximate, and the Contractor shall conduct its operations with caution and satisfy itself as to the accuracy of the information given. The Contractor shall not claim nor shall it be entitled to receive compensation for damages sustained by reason of the inaccuracy of the information given or by reason of its failure to properly maintain and support such structures.

3. There may be other subsurface facilities, the existence and/or location of which are not known, such as individual water and gas services, electrical conduits, storm drains, etc. The Contractor shall consult with GE or GE's Representatives of such facilities and, if possible, shall determine, prior to construction, the location and depth of any such facilities that may exist in the area to be excavated.

4. If underground facilities are known to exist in an area but their location is uncertain, the Contractor shall exercise reasonable care in its excavation technique to avoid damage to them.

5. The Contractor shall notify Massachusetts DIGSAFE 72 hours prior to the start of site work and provide/perform required information/activities.

B. Notification and Protection Procedures

1. Except where superseded by state or local regulations, or in the absence of any applicable regulations, the Contractor shall, as a minimum, include the following procedures in its operations:

a. Prior to Excavating

1. Determine correct field location of all nearby underground facilities to arrange for Representatives of the utilities to locate them.

2. Notify owners of nearby underground facilities when excavating is to take place, allowing them reasonable time to institute precautionary procedures or preventive measures that they deem necessary to protect their facilities.

3. In cooperation with owners of nearby facilities, provide temporary support and protection of those underground facilities that may be especially vulnerable to damage by virtue of their physical condition or location, or those that could create hazardous conditions if damaged.

b. Immediately notify any utility owner of any damage to its underground facilities resulting from the Contractor's operations, and arrange for repairs to be made as soon as possible.

c. In case of an electrical short, or escape of gas or hazardous fluids (resulting from damage to an underground facility), immediately notify GE and all persons who might be endangered and assist in evacuation of people from the area.

3.09 OTHER REQUIREMENTS

A. Unfinished work

1. When, for any reason, the work is to be left unfinished, all excavations shall be filled and all roadways and watercourses left unobstructed with their surfaces in a safe and satisfactory condition. The surface of all roadways shall have temporary pavement.

B. Hauling Material on Street

1. When hauling material over the streets or pavement, the Contractor shall provide suitable tight vehicles so as to prevent deposits on the streets or pavements. In all cases where any materials are dropped from the vehicles, the Contractor shall clean up the same as often as required to keep the crosswalks, streets, and pavements clean and free from dirt, mud, stone, and other hauled material. Related activities shall be coordinated with GE or GE's representative.

2. When hauling materials that contain PCBs or other hazardous constituents, the Contractor shall abide by all applicable federal, state, and local codes, including, but not limited to, manifesting and placarding (if necessary). Related activities shall be coordinated with GE or GE's representative.

C. Dust Control

1. It shall be the sole responsibility of the Contractor to control the dust created by any and all of its operations to such a degree that it will not endanger the safety and

MATERIALS AND PERFORMANCE - SECTION 02200

EARTHWORK

welfare of the general public. Relater activities shall be performed in accordance with applicable Occupational Safety and Health Administration (OSHA) and Project Operations Plan (POP) requirements.

- END OF SECTION -

MATERIALS AND PERFORMANCE - SECTION 02222

SOIL FILL MATERIALS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Work under this section shall include, but not necessarily be limited to, supplying all labor and materials, excavating, transporting, dumping, spreading, and compacting Soil Fill Materials in the locations and to the depth shown on the Technical Drawings and/or as directed by GE or GE's Representative.

B. Applicable Standards and Specifications

1. American Society for Testing Materials (ASTM).

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section MP-02212 – Topsoil, Seeding and Mulch.
B. Section MP-02200 - Earthwork

1.03 SUBMITTALS

A. The name, location, and quantity of each source and type of soil fill material proposed by the Contractor including a sample of each source and soil fill type to be sampled for PCBs, volatile organic compounds (VOCs), Semi-VOCs, and metals. The results of the analyses will be compared to the appropriate regulatory levels. If such analyses indicate unacceptable chemical characteristics, GE will reject the use of fill materials from the proposed source(s), and the Contractor must identify and submit a sample(s) from another fill source. If a fill source is rejected by GE, analytical testing for one additional fill source will be performed at the expense of GE. If additional fill sources (more than two sources per fill material) are rejected, additional testing will be at the expense of the Contractor.

Soil sampling results previously submitted to, and approved by GE (within the last calendar year), for the proposed sources can be submitted to GE in lieu of additional testing. However, GE reserves the right to request additional verification testing prior to source approval.

B. Contractor shall provide a grain size analysis (ASTM D422) for each source and type of soil fill material.

MATERIALS AND PERFORMANCE - SECTION 02222

SOIL FILL MATERIALS

PART 2 - PRODUCTS

2.01 MATERIALS

A. Select fill shall be the type listed below:

Leachate Pipe Cover Aggregate

1. Material placed above the leachate collection piping shall be washed, rounded run-of-bank gravel, with a d_{max} of 1 ½-inches and a d_{min} of 3/4-inches.

B. General Fill shall be the type listed below:

Subbase and Earthen Berms

1. Material to be used to construct the base liner system subbase and for the earthen berms (i.e., perimeter berms) shall be free of large (greater than 2-inches) objects, sticks, roots, or any other deleterious materials. Materials must provide a compacted, smooth, uniform surface free from any protruding objects that could damage the overlying FML. Materials must be capable of achieving the minimum compaction requirements presented in Section MP-02200.

PART 3 - EXECUTION

3.01 PLACEMENT

A. The entire surface to be covered with General Fill material shall be stripped of all grass, vegetation, topsoil, rubbish, or other unsuitable materials before backfilling.

B. In general, soil fill material shall be placed and compacted in horizontal layers no less than 3 inches and not exceeding those thicknesses indicated in Section MP-02200. The subgrade for placement of soil fill material shall be approved by GE or GE's Representative. Soil fill material shall not be placed on ground that shall not support the weight of construction equipment.

C. Each layer of soil fill material shall be thoroughly tamped or rolled to the required degree of compaction by mechanical tampers, or vibrators. Successive layers shall not be placed until the layer under construction has been thoroughly compacted.

D. Trucks or other heavy equipment shall not be operated over the fill layer until the minimum thickness of soil fill has been placed and properly compacted by tampers or other approved method.

E. Where required, the Contractor shall, at its own expense, moisture condition the fill to meet the compaction requirements. If, due to rain or other causes, the material is too wet for

satisfactory compaction, it shall be allowed to dry or be removed as required, before compaction.

F. At the end of a day, the Contractor shall track the slope with a bulldozer perpendicular to the slope to help minimize erosion.

3.02 FIELD TESTING AND QUALITY CONTROL

A. In-place density testing shall be performed by an independent testing laboratory at the Contractor's expense. Testing shall be performed in accordance with ASTM D2922. In-place density testing shall be as specified in the Section MP-02200.

3.03 CRITERIA AND TOLERANCES

A. Soil fill materials shall be constructed to such heights as to allow for post-construction settlement. Any settlements that occur before final acceptance of the Contract shall be corrected to make the backfill conform with the established lines and grades.

- END OF SECTION -

MATERIALS AND PERFORMANCE - SECTION 02232

GEOTEXTILE FABRIC

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Contractor shall supply all labor, materials, tools, and equipment required to furnish and install geotextile fabric as specified herein and as shown on the Technical Drawings or as indicated by GE or GE's Representative.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1.	D5261-92	Unit Weight
2.	D4632-91	Grab Tensile and Grab Elongation
3.	D3786	Mullen Burst
4.	D4833-00	Puncture
5.	D4533-91	Trapezoidal Tear
6.	D4355-99	Ultraviolet Resistance

1.03 SUBMITTALS

A. Manufacturer's data for geotextile including, at a minimum, physical properties, packaging, and installation techniques.

B. Manufacturer's quality assurance/quality control program.

C. Certified results of all quality control testing.

D. Contractor's proposed on-site transportation, handling, storage, and installation techniques.

E. Manufacturer's standard warranty provided for the geotextiles.

PART 2 - PRODUCT

2.01 ACCEPTABLE MANUFACTURERS

A. Skaps Industries;
B. Propex Fabrics; or
C. Equal.

2.02 MATERIALS

A. For these specifications and the Technical Drawings, the terms "geotextile" and "geotextile fabric" shall be considered synonymous.

MATERIALS AND PERFORMANCE - SECTION 02232

GEOTEXTILE FABRIC

B. Geotextile fabric to be used shall be of the types listed below:

Type 1: Non-Woven Geotextile, to be used for base liner construction
Type 2: Polypropylene Woven Geotextile stabilized to resist degradation due to ultraviolet exposure, to be used as protection geotextile above exposed geosynthetic drainage composite

C. The non-woven geotextile shall be of needle-punched construction and consist of long-chain polymeric fibers or filaments composed of polypropylene, shall be free of any chemical treatment that reduces permeability, and shall be inert to chemicals commonly found in soil.

D. The non-woven geotextiles indicated on the Technical Drawings shall have the minimum physical properties listed below:

Type 1: Non-Woven Geotextile

Property	Unit of Measure	Test Method	Minimum Test Value
Grab Tensile	lbs.	ASTM D4632	300
Grab Elongation	%	ASTM D4632	50
Mullen Burst	psi	ASTM D3786	580
Puncture	lbs	ASTM D4833	175
Trapezoidal Tear	lbs	ASTM D4533	115
UV Resistance	% Retained @ 500 hrs.	ASTM D4355	70
Unit Weight	$oz./yd.^2$	ASTM D5261	12
Permittivity	sec^{-1}	ASTM D4491	0.05

Type 2: Polypropylene Woven Geotextile

Property	Unit of Measure	Test Method	Minimum Test Value
Grab Tensile	lbs.	ASTM D4632	180
Mullen Burst	psi	ASTM D3786	305
Puncture	lbs	ASTM D4833	70
Trapezoidal Tear	lbs	ASTM D4533	70

MATERIALS AND PERFORMANCE - SECTION 02232

GEOTEXTILE FABRIC

2.03 DELIVERY, STORAGE AND HANDLING

A. The geotextile shall be furnished in a protective wrapping that shall be labeled with the following information: manufacturer's name, product identification, lot #, roll #, and dimensions.

B. The geotextile shall be protected from ultraviolet light, precipitation, mud, soil, excessive dust, puncture, cutting, and/or other damaging conditions prior to and during delivery and on-site storage. The geotextile shall be stored on-site at a location approved by GE or GE's Representative.

2.04 QUALITY ASSURANCE

A. The field-delivered fabric shall meet the specification values according to the manufacturer's specification sheet. The Contractor shall submit written certification that the delivered material meets the manufacturer's specifications. The Contractor shall provide the quality control test results conducted by the manufacturer during the manufacturing of the geotextile fabric delivered to the project site. The results shall identify the sections/panels of field-delivered fabric they represent. The Contractor shall also provide the lot and roll number for the fabric delivered to the site.

B. The manufacturer shall have developed and shall adhere to its own quality assurance program in the manufacture of the geotextile.

C. The installer shall verify, in writing and prior to installation, that the geotextile fabric has not been damaged due to improper transportation, handling, or storage.

PART 3 - EXECUTION

3.01 PREPARATION

A. Prior to installing the geotextile, placement surfaces shall be leveled and uniformly compacted, as necessary, to provide a stable interface for the geotextile that is as smooth as possible.

3.02 GEOTEXTILE INSTALLATION

The following procedures and requirements will be followed during the geotextile installation.

A. Placement

1. Placement of the geotextile shall not be conducted during adverse weather conditions. The geotextile shall be kept dry during storage and up to the time of deployment. During windy conditions, all geotextiles shall be secured with sandbags or an equivalent approved anchoring system. Removal of the sandbags or equal shall only occur upon placement of an overlying soil layer. Sandbags will remain on the

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GEOTEXTILE FABRIC

Type 2 geotextile as necessary to ensure complete coverage of underlying geosynthetic drainage composite during adverse weather conditions.

2. Proper cutting tools shall be used to cut and size the geotextile materials. Extreme care shall be taken while cutting geotextiles.

3. During the placement of geotextiles, all dirt, dust, sand, and mud shall be kept off to prevent clogging. If excessive containment materials are present on the geotextile, it shall be cleaned or replaced as directed by GE or GE's Representative.

4. The Type 1 geotextile shall be covered within the time period recommended by the manufacturer, and in no case later than two weeks after its placement.

5. In all cases, seams on sideslopes shall be parallel to the line of slope. No horizontal seams shall be allowed on side slopes.

B. Seaming and Repairing

1. Geotextiles shall be continuously sewn using a polymeric thread with chemical and ultraviolet resistance properties equal to or exceeding those of the geotextile.

2. Repair of tears or holes in the geotextile shall require the following procedures:

a. On slopes: A patch made from the same geotextile shall be double seamed into place; with each seam 1/4-inch to 3/4-inch apart and no closer than 1 inch from any edge. Should any tear exceed 10% of the width of the roll, that roll shall be removed from the slope and replaced.

b. Non-slopes: A patch made from the same geotextile shall be spot-seamed in place with a minimum 24-inch overlap in all directions.

3.03 POST-CONSTRUCTION

A. Upon completing the installation, the Contractor shall submit to GE or GE's Representative:

1. All quality control documentation and the as-built panel drawings.

3.04 WARRANTY

A. The Contractor shall obtain from the manufacturer and submit to GE or GE's Representative, a standard warranty provided for the geotextiles.

- END OF SECTION -

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FLEXIBLE MEMBRANE LINER

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Under this section, the Contractor shall furnish and install 60-mil thick, textured high-density polyethylene (HDPE) Flexible Membrane Liner (FML) material as shown on the Technical Drawings, and as specified herein and/or directed.

2. The Contractor shall be responsible for all Quality Assurance/Quality Control (QA/QC) testing specified herein and as indicated on the Technical Drawings. All QA/QC testing, with the exception of non-destructive tests, shall be conducted by an independent laboratory at the Contractor's expense.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section MP-02219 - Geosynthetic Drainage Composite
B. Section MP-02232 - Geotextile Fabric

1.03 APPLICABLE CODES, STANDARDS, SPECIFICATIONS, AND PUBLICATIONS

A. American Society for Testing and Materials (ASTM)

1. D6693 Tensile Properties of Plastics

2. D1505/792 Specific Gravity and Density of Plastics by Displacement

3. D1004-94a Initial Tear Resistance of Plastic Film and Sheeting

4. D1505-98 Density of Plastics by the Density Gradient Technique

5. D1603-01 Carbon Black in Olefin Plastics

6. D5397-99 Environmental Stress-Cracking of Ethylene Plastics

7. D5994-98 Core Thickness of Textured Geomembrane

8. D5596-94 Microscopical Examination of Pigment Dispersion in Plastic Compounds

9. D4833-97 Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products

10. D1603 Carbon Black Content

B. Geosynthetic Research Institute (GRI)

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FLEXIBLE MEMBRANE LINER

GRI Test Method GM 13	Test Properties, Testing Frequencies and Recommended Warrant for High-Density Polyethylene (HDPE) Smooth and Textured Geomembranes

C. Where reference is made to one of the above codes, standards, specifications, or publications the revisions in effect at the time of bid shall apply.

1.04 QUALIFICATIONS

A. FML Manufacturer

1. The Contractor shall submit to GE or GE's Representative for approval the following information regarding the FML Manufacturer:

a. Corporate background and information.

b. Manufacturing capabilities including:

- Quality control procedures for manufacturing; and
- List of material properties including certified test results, to which FML samples are attached.

c. A list of at least 10 completed facilities, totaling a minimum of 10,000,000 ft^2, for which the Manufacturer has manufactured FMLs. For each facility, the following information shall be provided:

- Name and purpose of facility, its location, and date of installation;
- Name of Owner, Project Manager, Designer, Fabricator (if any), and Installer; and
- Thickness of FML, surface area of FML manufactured.

d. Origin (resin supplier's name, resin production plant) and identification (brand name, number) of the resin.

B. Installer

1. The Installer must be trained and approved and/or licensed by the FML Manufacturer for the installation of FML.

2. The Contractor shall submit to GE or GE's Representative for approval the following written information, relative to the Installer:

a. Copy of Installer's letter of approval or license by the Manufacturer.

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FLEXIBLE MEMBRANE LINER

b. Resume of the "master seamer" to be assigned to this project, including dates and duration of employment.

3. All personnel performing seaming operations shall be qualified by experience or by successfully passing seaming tests. At least one seamer shall have experience seaming a minimum of 1,000,000 ft^2 of FML of the type for this project, using the same type of seaming apparatus in use at the site.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Solmax Geosynthetics;
B. PolyFlex; or
C. Equal.

2.02 MATERIALS

A. HDPE Lining Material Specifications

1. HDPE FML material shall meet the following minimum specification values listed below and as listed in GRI GM13.

Property	Test Method	Specification Limit (MARV)
		60 mil Textured
HDPE FML Resin		
Specific Gravity (min.)	ASTM D1505/D792	.940
Carbon Black Content	ASTM D1603/D4218	2.0 - 3.0%
Carbon Black Dispersion	ASTM D5596	1, 2 or 3 category All 10 views
HDPE FML Rolls		
Thickness (nominal)	ASTM D5994	60 mil
Thickness (min. avg.)		57 mil
lowest individual 8 of 10 values		54 mil
lowest individual of 10 values		51 mil

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Property	Test Method	Specification Limit (MARV)
		60 mil Textured
Density (min.)	ASTM D1505/D792	.940
Tensile Properties		
Tensile Strength at Break (min.)	ASTM D638 Type IV	90 ppi
Tensile Strength at Yield (min.)		126 ppi
Elongation at Break (min.)		100%
Elongation at Yield (min.)		12%
Tear Resistance (min.)	ASTM D1004	42 lbs
Puncture Resistance (min.)	ASTM D4833	90 lbs
Stress Crack Resistance	ASTM D5397	200 Hour

B. Welding Material

1. The resin used in the welding material must be identical to the liner material.

2. All welding materials shall be of a type recommended and supplied by the manufacturer and shall be delivered in the original sealed containers, each with an indelible label bearing the brand name, manufacturer's mark number, and complete directions as to proper storage.

C. Labeling FML Rolls

1. Labels on each roll or factory panel shall identify the following:

- Thickness of the material;
- Length and width of the roll or factory panel;
- Manufacturer;
- Directions to unroll the material;
- Product identification;
- Lot number; and
- Roll or field panel number.

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FLEXIBLE MEMBRANE LINER

2.03 DELIVERY, HANDLING, AND STORAGE

A. The Contractor shall be liable for all damages to the materials incurred prior to and during transportation to the site.

B. Handling, storage, and care of the FML prior to and following installation at the site is the responsibility of the Contractor. The Contractor shall be liable for all damages to the materials incurred prior to final acceptance of the lining system by GE or GE's Representative.

C. The Contractor shall notify GE or GE's Representative of the anticipated delivery time.

2.04 ADDITIONAL SUBMITTALS

A. The Contractor shall submit the following items for approval at least one week prior to installation:

1. Shop drawings that shall include:

a. Layout plan;

b. Quality control program manuals covering all phases of manufacturing and installation; and

c. Complete and detailed written instructions for the storage, handling, installation, seaming, inspection plan fail criteria for liner inspections, and QA/QC testing procedures of the liner in compliance with these specifications and the condition of its warranty.

PART 3 - EXECUTION

3.01 FML INSTALLATION

A. Related Earthwork

1. The Contractor shall ensure that all related earthwork requirements under this section are complied with:

a. The FML installations shall be performed on a firm, smooth, soil or geotextile-covered surface free from stones or protruding objects.

b. No FML shall be placed onto an area that has become softened by precipitation. Appropriate methods of moisture control are the responsibility of the Contractor.

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c. No FML shall be placed on frozen soil material. Such material shall be removed and replaced with new soil fill as specified in the Section MP-02222 - Soil Fill Materials.

d. The FML Installer shall certify in writing that the final surface on which the FML is to be installed is acceptable.

e. All surfaces on which the FML is to be installed shall be acceptable to GE or GE's Representative prior to FML installation.

f. Free edges of FML shall be secured so as to prevent uplift by wind or the intrusion of water under the liner. Edge protection shall include sandbags, polyethylene sheeting, or other methods as deemed necessary by the Contractor and approved by GE or GE's Representative.

g. The FML shall be anchored within an anchor trench constructed to the dimensions shown in the Technical Drawings. Care shall be taken while backfilling the trenches to prevent damage to the FML.

B. FML Deployment

1. FML shall be deployed according to the following procedures:

a. Placement of the FML panels shall be according to the approved location and position plan provided by the Installer. Placement shall follow all instructions on the boxes or wrapping containing the FML materials that describe the proper methods of unrolling panels.

b. The method of placement must ensure that:

- Deployed FML must be visually inspected for uniformity, tears, punctures, blisters, or other damage or imperfections. Any such imperfections shall be immediately repaired and reinspected.

- No equipment used shall damage the FML by handling, trafficking, leakage of hydrocarbons, or other means.

- No personnel working on the FML shall smoke, wear damaging shoes, or engage in other activities that could damage the FML.

- The prepared surface underlying the FML must not be allowed to deteriorate after acceptance, and must remain acceptable up to the time of FML placement and until completion of the project.

- Adequate temporary loading and/or anchoring (e.g., sand bags), not likely to damage the FML, shall be placed to prevent uplift by wind (in case of high winds, continuous loading is recommended along edges of panels to minimize risk of wind flow under the panels).

- Direct contact with the FML shall be minimized (i.e., the FML in excessively high-traffic areas shall be protected by geotextiles, extra FML, or other suitable materials).

c. Any damage to the FML panels or portions of the panels as a result of placement must be replaced or repaired at no cost to GE or GE's Representative. The decision to replace or repair any panel or portions of panels shall be made by GE or GE's Representative.

d. The Installer shall assign an "identification number" to each FML panel placed. The number system used shall be simple, logical, and shall identify the relative location in the field.

C. Seaming

1. The seaming procedures below shall be implemented, where applicable, during installation of the FML. The seaming procedures are as follows:

a. Generally, all seams whether field or factory, shall be oriented parallel to the line of slope, not across slope. At liner penetrations and corners, the number of seams shall be minimized.

b. The area of the FML to be seamed shall be cleaned and prepared according to the procedures specified by the material manufacturer. Any abrading of the FML shall not extend more than one-half inch on either side of the weld. Care shall be taken to eliminate or minimize the number of wrinkles and "fishmouths" resulting from seam orientation.

c. Field seaming is prohibited when either the air or sheet temperature is below 32°F, or when the sheet temperature exceeds 122°F, or when the air temperature is above 104°F. At air or sheet temperatures between 32°F and 40°F, seaming shall be conducted directly behind a preheating device. In addition, seaming shall not be conducted when FML material is wet from precipitation, dew, fog, etc., or when winds are in excess of 20 miles per hour.

d. Seaming shall not be performed on frozen or excessively wet underlying soil surfaces.

e. Seams shall have an overlap beyond the weld large enough to perform destructive peel tests, but shall not exceed 5 inches.

f. The Contractor shall perform trial seams on excess FML material. A 1-foot by 3-foot seamed liner sample shall be fabricated with the seam running down the 3-foot length in the center of the sample. Such trial seaming shall be conducted prior to the start of each seaming succession for each seaming crew, change in machine or every 4 hours, after any significant change in weather conditions or FML temperature, or after any change in seaming equipment. From each trial seam, four field test specimens shall be taken. The test specimens shall be 1-inch by 12-inch strips cut perpendicular to the trial seam. Two of these specimens shall be shear tested and two shall be peel tested using a field tensiometer, and recorded as pass (failure of liner material) or fail (failure of seam). Upon initial failure, a second trial seam shall be made; if both trial seams fail, then the seaming device and its operator shall not perform any seaming operations until the deficiencies are corrected and two successive passing trial seams are produced. Completed trial seam samples cannot be used as portions of a second sample and must be discarded.

g. Where fishmouths occur, the material shall be cut, overlapped, and an overlap weld shall be applied. Where necessary, patching using the same liner material shall be welded to the FML sheet.

h. Acceptable seaming methods for FML are:

- Extrusion welding using extrudate with identical physical, chemical, and environmental properties; and
- Hot wedge welding using a proven fusion welder and master seamer.

i. Seaming device shall not have any sharp edges that might damage the FML. Where self-propelled seaming devices are used, it shall be necessary to prevent "bulldozing" of the device into the underlying soil.

D. Seam Testing

1. The Contractor shall perform nondestructive seam testing on 100 percent of field seams. The following test method and procedures may be used:

a. Air pressure testing may be used if double-track hot-wedge welding has been used to seam the HDPE FML. Using approved pressure testing equipment, the following procedures will be followed:

- Seal both ends of the air channel separating the double-track hot-wedge welds;
- Insert pressure needle into air channel and pressurize the air channel to 27 psi;
- Monitor pressure gauge for 3 minutes and determine whether pressure is maintained without a loss of more than 2 psi; and

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- If the pressure test fails, then localize the leak and mark the area for repair.

Air pressure testing will be conducted under the direct observation of GE or GE's Representative.

b. Vacuum testing will be used on all seams not tested using air pressure testing. Using an approved vacuum box, the following procedures will be followed:

- Apply a soapy water mixture over the seam;
- Place vacuum box over soapy seam and form a tight seal;
- Create a vacuum by reducing the vacuum box pressure to 5 psi for 10 seconds;
- Observe through the vacuum box window any bubbles;
- Where bubbles are observed, mark seam for repair;
- Move vacuum box further down seam overlapping tested seam by 3 inches; and
- Where hot-wedge seaming has been performed, the overlap must be cut back to the weld.

All vacuum testing will be conducted under the direct observation of GE or GE's Representative.

2. In addition to nondestructive seam testing, the Contractor will perform destructive testing. The destructive testing procedures are as follows:

a. Test samples will be prepared by the Installer every 500 feet of seam length, a minimum of one test for each seaming machine per day, or more frequently at the discretion of GE or GE's Representative. Sample location and size will be selected by GE or GE's Representative. The sample size (12 x 56 inches) will be large enough to produce three sets of test specimens for the following tests:

- Seam Shear Strength, ASTM D6392; and
- Peel Adhesion, ASTM D6392.

b. Ten specimens will compose a set. Five of these will be tested for peel and the other five for shear strength. Each specimen will be 1-inch wide and 12-inches long with the field seam at the center of the specimen. The 56-inch sample length will first be cut at the ends to produce two field peel test specimens. The remaining 54 inches will be divided up into thirds and one-third submitted to the Contractor, one-third to the independent testing laboratory, and one-third to GE or GE's Representative for storage and future reference.

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c. Test specimens will be considered passing if the minimum values below are met or exceeded for four of the five test specimens tested by the independent laboratory. All acceptable seams will lie between two locations where samples have passed.

d. The cost of destructive testing will be borne by the Contractor.

e. Seams will meet the following minimum specification values listed below and as listed in GRI Test Method GM19:

Seam Properties	Specification Limit	Test Method
Shear Strength at Yield (lb/in width)	120 ppi	ASTM D6392
Peel Adhesion – Fusion	91 ppi and Film tear bond	ASTM D6392
Peel Adhesion - Extrusion	78 ppi and Film tear bond	ASTM D6392

3. If a sample fails destructive testing, the Contractor shall ensure that: the seam is reconstructed in each direction between the location of the sample that failed and the location of the next acceptable sample; or the welding path is retraced to an intermediate location at least 10 feet in each direction from the location of the sample that failed the test, and a second sample is taken for an additional field test. If this second test sample passes, the seam must be then reconstructed between the location of the second test and the original sampled location. If the second sample fails, the process must be repeated.

   All costs for work performed to achieve passing tests along with costs for retesting will be borne by the Contractor.

4. If double-track hot-wedge welding is used, GE or GE's Representative and the Installer must agree on the track weld that will be used in the destructive testing. The weld chosen inside or outside must be consistently tested, and must pass according to the criteria above.

5. All holes created by cutting out destructive samples will be patched by the Contractor immediately with an oval patch of the same material welded to the membrane using extrusion welding. The patch seams will be tested using a vacuum box and using the procedures described above. Work will not proceed with materials covering the FML until passing results of destructive testing have been achieved.

6. At the ends of each field seam, two field test specimens will be taken and field tested with a field tensiometer. Both specimens must pass prior to placing the membrane in the anchor trench or continuing with additional seams. Failure of these specimens

will require correcting the seaming device and repair of the preceding seam according to the failure testing and procedures described above.

E. Liner Repair

1. All imperfections, flaws, construction damage, and destructive and nondestructive seam failures shall be repaired by the Installer of the FML. The appropriate methods of repair are listed below:

- Patching, used to repair holes, tears, undispersed raw materials, and contamination by foreign matter;
- Grinding and rewelding, used to repair small sections of extruded seams;
- Spot welding or seaming, used to repair pinholes or other minor, localized flaws;
- Capping, used to repair large lengths of failed seams;
- Topping, used to repair areas of inadequate seams which have an exposed edge; and
- Removing bad seams and replacing with a strip of new material welded into placed, used with large lengths of fusion seams.

F. Construction Material Placement and Penetrations

1. Wrinkles that develop from normal placement procedures must be controlled such that the underlying FML does not fold over. Small wrinkles, defined as having their height less than or equal to one-half their base width, may be trapped and pushed down by the overlying soil. Any wrinkle that becomes too large and uncontrollable or that folds the FML over must be brought to the attention of GE or GE's Representative. If necessary, the FML shall be uncovered, cut, laid flat, seamed by extrusion welding, and non-destructively tested.

3.02 POST-CONSTRUCTION

A. The Installer of the FML materials shall prepare and the Contractor shall submit to GE or GE's Representative, record drawings illustrating the following information:

- Dimensions of all FML field panels;
- Panel locations referenced to the Technical Drawings;
- All field seams and panels with the appropriate number or code; and
- Location of all patches, repairs, and destructive testing samples.

3.03 WARRANTY

A. The Contractor shall obtain and submit to GE or GE's Representative from the Manufacturer a standard warranty provided for the FML.

- END OF SECTION -